REMARKS

In accordance with the foregoing, claims 1,3-18, 20, 22, and 25 are pending and under consideration. It is respectfully submitted that the rejections are traversed.

REJECTIONS UNDER 35 U.S.C. §103:

I. Claims 1 and 17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo et al. ("Improving Spectral Efficiency by Ultra-Narrow Optical Filtering to Achieve MultTerabit/s Capacities", OFC 2002, 17-22 March 2002) in view of Miyamoto (6,865,348).

Claim 1 recites:

> a plurality of optical senders outputting signal lights with different wavelengths and filtered by a plurality of respective filters to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency *maximizing* a product of a transmission distance and a transmission capacity of the system;
>
> wherein the type of modulation of said signal light is determined to be an NRZ modulation type.

Bigo relates to a WDM transmission system that has centered optical filters on each channel before wavelength multiplexing at the Tx end simulating channels using Non-Return-to-Zero (NRZ) or Return-to-Zero (RZ) formats. Bigo states that strong filtering at Tx benefits to both formats in back-to-back, but the RZ format recovers the better sensitivity performance over NRZ seen in single-channel mode. After transmission, strong filtering at Tx is also found to reduce transmission impairments, but only for Rz format. Bigo further states that the Tx optical filtering applied to RZ format not only reduces channel linear crosstalk (Fig. 1), and thus improved the back-to-back performance, but also the transmission quality, whereas it only slightly reduces linear cross-talk for NRZ. With narrow filters at Tx, RZ recovers in WDM the advantage over NRZ it has when a single channel is transmitted.

Bigo teaches that the spectrum efficiency is substantial for the RZ format but is minimal in relation to the NRZ format. Bigo teaches away from the "signal light is determined to be an

NRZ modulation type" and the filtered signal lights "having respective bit rates and frequency spacing to approach a spectrum efficiency *maximizing* a product of a transmission distance and a transmission capacity of the system." Therefore, claim 1 patentably distinguishes over the cited art.

Bigo's WDM transmission system also contains a polarization demultiplexer consisting of a polarization controller and a polarizer. The BERs of one random 10.7 Gbits/s tributary of all 128 channels along one of the two polarizations were measured plus that of some channels along the orthogonal one.

Miyamoto et al. relates to a system that includes generating a partial response signal by converting a binary NRZ signal from a digital signal source, modulating the optical pulse signal passed on the partial response signal, and outputting a binary RZ modulated signal. A transmitted optical signal is demultiplexed by an optical-wavelength-division demultiplexing section 105 into carrier-suppressed RZ optical duobinary encoded signals having corresponding wavelengths. *See* col. 29, lines 24-28. A band dividing section may be formed using a super Gaussian band-pass filter. *See* col. 30, lines 47-51. Miyamoto et al. does not contain a polarization demultiplexer, a polarization controller, or a polarizer.

Miyamoto et al. does not teach or suggest:

> a plurality of optical senders outputting signal lights with different wavelengths and filtered by a plurality of respective filters to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency maximizing a product of a transmission distance and a transmission capacity of the system;
>
> wherein the type of modulation of said signal light is determined to be an NRZ modulation type.

Therefore, claim 1 patentably distinguishes over the cited art.

It would not have been obvious to one skilled in the art at the time the invention was made to combine Bigo with Miyamoto et al. because Bigo uses a polarization demultiplexer consisting of a polarization controller and a polarizer in an attempt to achieve the spectrum efficiency. Orthogonal polarization transmission assemblies and polarization division multiplexing transmission assemblies become very complicated as the number of parts in an optical sender and receiver increase. Therefore, size and costs increase.

Miyamoto contains a super Gaussian band-pass filter rather than a polarization division multiplexing transmission assembly. Even though one skilled in the art at the time the invention was made would use a super Gaussian band-pass filter in a transmission system, it would not have been obvious to use the filter "to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency maximizing a product a product of a transmission distance and a transmission capacity of the system ... wherein the type of modulation of said signal light is determined to be an NRZ modulation type," since Miyamoto et al. does not even teach or suggest the quoted feature.

Therefore, it would not have been obvious to one skilled in the art at the time the invention was made to combine Bigo and Miyamoto et al. Therefore, claim 1 patentably distinguishes over the cited art.

Claim 17 recites:

> demultiplexing wavelength division multiplexed signal light propagated through said optical transmission path according to wavelength to receive,
>
> wherein the type modulation of said signal light is determined to be an NRZ modulation type, and
>
> wherein a bit rate and frequency spacing of the signal lights are set so as to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity becomes maximum, and actual transmission characteristics at the time of multiplexing and demultiplexing the signal light are set in accordance with said equation model, to transmit the wavelength division multiplexed signal light.

Accordingly, claim 17 patentably distinguishes over the cited art.

II. Claims 3-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo and Miyamoto, and further in view of Frankel et al. (6,496,297).

Claims 3-12 depend from claim 1 and include all of the features of that claim, plus additional features which are not taught or suggested by the cited art and therefore patentably distinguish over the cited art. Furthermore, nothing has been cited or found in Frankel et al. that cures the deficiencies in regards to Bigo in view of Miyamoto.

III. Claim 13 is rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo and Miyamoto, and further in view of Ramaswami et al. ("Optical Networks", second Edition by Ramaswami et al., Academic Press, 2002, Published 12 October 2001, pp. 139-143)

Claim 13 depends from claim 1 and includes all of the features of that claim, plus additional features which are not taught or suggested by the cited art and therefore patentably distinguish over the cited art. Furthermore, nothing has been cited or found in Ramaswami et al. that cures the deficiencies in regards to Bigo in view of Miyamoto.

IV. Claim 14 is rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo, Miyamoto, and Frankel, and further in view of Ramaswami.

Claim 14 depends from claim 1 and includes all of the features of that claim, plus additional features which are not taught or suggested by the cited art and therefore patentably distinguish over the cited art. Furthermore, nothing has been cited or found in Ramaswami et al. or Frankel that cures the deficiencies in regards to Bigo in view of Miyamoto.

V. Claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo, Miyamoto, and Frankel, and further in view of Koshi (US 2002/0025111)

Claim 15 depends from claim 1 and includes all of the features of that claim, plus additional features which are not taught or suggested by the cited art and therefore patentably distinguish over the cited art. Furthermore, nothing has been cited or found in Frankel or Koshi that cures the deficiencies in regards to Bigo in view of Miyamoto.

VI. Claims 16 and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Bigo and Miyamoto, and further in view of Guy (6,690,886).

Claim 25 recites:

> optimizing a transmission characteristic corresponding to each light signal by superimposing a gaussian filter centered on a frequency of each light signal, which narrows a bandwidth of the light signal before multiplexing the light signals,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type.

Guy states that the reason for the high degree of crosstalk between channels due to four-wave mixing (FWM) is the small channel spacing used which increases as one attempts to increase the capacity and spectral efficiency by further reducing the channel spacing. The FWM process imposes a limitation on the maximum reach, capacity, and spectral efficiency that can be achieved in a very densely packed WDM system.

Guy does not teach or suggest "optimizing a transmission characteristic corresponding to each light signal by superimposing a gaussian filter centered on a frequency of each light signal, which narrows a bandwidth of the light signal before multiplexing the light signals, wherein the type of modulation of said signal light is determined to be an NRZ modulation type."

Furthermore, the Examiner stated on page 7 that the "instant specification admits that when the performance index is maximized, the product of a transmission distance and a transmission capacity is also maximized." The Examiner did not state where in the specification that this is admitted. Only citations identified as "prior art" may be cited in rejecting the claims, and not the specification in general. Where the specification identifies work done by another as "prior art," the subject matter so identified is treated as admitted prior art. In re Nomiya, 509 F.2d 566, 571, 184 USPQ 607, 611 (CCPA 1975). Furthermore, "performance index" is not recited in the claim. Accordingly, the rejection of claim 25 is inappropriate and the claim patentably distinguishes over the cited art.

Claim 16 depends from claim 1 and includes all of the features of that claim, plus additional features that are not taught or suggested by the cited art and therefore patentably distinguishes over the cited art. Furthermore, nothing has been cited in Guy that cures the deficincies of Bigo in view of Miyamoto.

VII. Claims 18, 20 and 22 are under 35 U.S.C. §103(a) as being unpatentable over Bigo, and Miyamoto, and further in view of Silberberg(7,035,484 B2).

Claim 18 recites:

a polarization independent filter narrowing a transmission bandwidth of the multiplexed signals,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type,

wherein said polarization independent filter has transmission characteristics in which a transmission bandwidth is set in accordance with an equation model expressed by the following equation in which each transmission band T(f) corresponding to each signal light is expressed as a function of a frequency f, fc being the center frequency of the transmission band, and Δf being a full width at half maximum of the transmission band,

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals of the plurality of wavelengths is eliminated by said polarization independent filter, thereby generating a wavelength division multiplexed light in which spacing of said optical signals is made narrower than an initial spectrum width to be output .

Silberberg relates to polarization independent filtering that can be achieved using a dual-polarization liquid crystal etalon filter that includes a nematic liquid crystal in a Fabry-Perot cavity. Silberberg does not teach or suggest:

wherein said polarization independent filter has transmission characteristics in which a transmission bandwidth is set in accordance with an equation model expressed by the following equation in which each transmission band T(f) corresponding to each signal light is expressed as a function of a frequency f, fc being the center frequency of the transmission band, and Δf being a full width at half maximum of the transmission band,

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals of the plurality of wavelengths is eliminated by said polarization independent filter, thereby generating a wavelength division multiplexed light in which spacing of said optical signals is made narrower than an initial spectrum width to be output

In further view of the arguments made above in regards to claim 1, it is respectfully submitted that it would not have been obvious to one skilled in the art at the time the invention was made to combine a polarization independent filter with Bigo and Miyamoto. Miyamoto uses a Gaussian filter to achieve its transmission characteristics. Bigo uses a polarization

demultiplexer consisting of a polarization controller and a polarizer. The Examiner states on page 7 that it would have been obvious to one of ordinary skill in the art at the time the invention nwas made to use polarization independent filters because "using polarization independent filters does not require any particular polarization control." This statement is contrary to Bigo, because a polarization controller is an essential part of its transmission system.

It is respectfully submitted that it would not have been obvious to one of ordinary skill in the art at the time the invention was made to use a polarization filter instead of the Gaussian filter of Miyamoto in the system of Bigo that requires a polarization controller. Accordingly, claim 18 patentably distinguishes over the cited art.

Claim 20 recites:

> a polarization independent filter narrowing a bandwidth of a spectrum,
>
> wherein the type of modulation of said signal light is determined to be an NRZ modulation type,
>
> wherein said polarization independent filter has transmission characteristics in which a transmission bandwidth is set in accordance with an equation model expressed by the following equation in which each transmission band T(f) corresponding to a signal light is expressed as a function of a frequency f, fc being a center frequency of the transmission band, and Δf being a full width at half maximum of the transmission band, and a filter order "n",
>
> wherein each component on a short wavelength side and a long wavelength side of each of said optical signals is eliminated by said polarization independent filter, thereby optical signals with a plurality of wavelengths in which spacing of said optical signals is made narrower than an initial spectrum width to be output.

Accordingly, it is respectfully submitted that claim 20 patentably distinguishes over the cited art.

Claim 22 recites:

> optimizing a transmission characteristic corresponding to each light signal by superimposing a gaussian filter centered on a frequency of each light signal, which narrows a bandwidth of the light signal before multiplexing the light signals,
>
> wherein the type of modulation of said signal light is determined to be an NRZ modulation type, and

wherein said gaussian filter has transmission characteristics in which transmission bandwidth is set in accordance with an equation model expressed by the following equation in which each transmission band T(f) corresponding to a signal light is expressed as a function of a frequency f, fc being a center frequency of the transmission band, and Δf being a full width at half maximum of the transmission band, and a filter order "n".

Accordingly, it is respectfully submitted that claim 22 patentably distinguishes over the cited art.

CONCLUSION:

There being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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By: _____
John C. Garvey
Registration No. 28,607

1201 New York Avenue, N.W.
Suite 700
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501